



RECIPE FOR A FIRE

SUBJECTS: Science, Mathematics, Health, Physical Education

GRADES: 4-8

DURATION: One class period of 30-45 minutes

GROUP SIZE: One class of 25-30 students (or less)

SETTING: Outdoors or in a gymnasium

KEY VOCABULARY: Heat, fuel, oxygen, fire triangle, firefighters

ANTICIPATORY SET: Can anyone tell me what is needed to build a fire? Today we are going to discuss the recipe for a successful fire

OBJECTIVES: The students will be able to define what makes up the Fire Triangle.

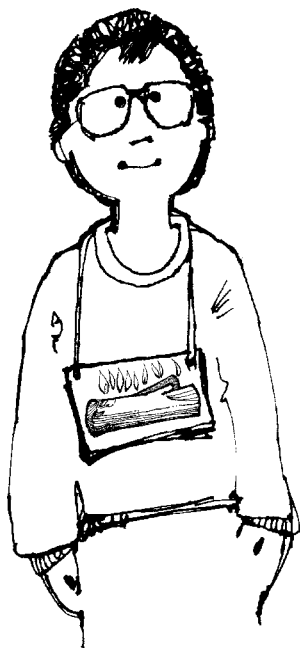
MATERIALS: Necklace Cards (provided in lesson) and string

BACKGROUND: Fire! Whether it is a cozy warm fire-place or towering flames 200 feet tall and a mile wide consuming a forest, all fire is essentially the same. Fire is a chemical reaction.

A more technical explanation is that fire is the naturally occurring companion of energy release in the form of heat and light when **oxygen** combines with a **combustible**, or burnable, material at a **suitably high temperature**. For simplicity's sake, you can call the combustible material **fuel**, and suitably high temperature **heat**. **Oxygen** of course is one of the ingredients in the air we breathe.

Fuel, heat and oxygen are all needed in the right combination to produce fire. These three in combination are called the **fire triangle**. We all know that a triangle has three sides and if one side is taken away the triangle cannot support itself. The same is true of fire. Take away any one of these three – fuel, heat or oxygen – and the fire is extinguished. Firefighters have studied the chemistry of fire and know if they remove just one of these components a fire cannot burn. The goal of a firefighter is to do just that – remove one the three main ingredients in the recipe of fire. For example, when a line is dug around a fire, fuel is removed. When water is sprayed on a building or dropped on a forest fire, it reduces the heat. Fire retardant (that bright, orange-red, soupy substance dropped from planes that we see on the news during fire season) coats fuels and blocks them from oxygen. If we think of fighting fire as a means of breaking the fire triangle, then it is easier to understand why firefighters do what they do.

Fire needs at least 16% oxygen (our atmosphere has 21%) to survive. If there is a steady supply of oxygen, fuel and temperature become critical in sustaining a fire once it is ignited. (The majority of our western wildland fires begin with a lightning strike. Did you know that on a typical day the Earth receives approximately 8 million lightning strikes?) The connection of fuel and temperature is unmistakable – the more fuel, the more intense the heat. The more intense the heat, the faster the fire spreads. When there is an abundance of heat and fuel, fires begin to take on a life of their own. If a fire is large enough it is capable of creating its own weather. Winds can increase to as much as 120 miles per hour, thus supplying more oxygen. High temperatures in a large fire heat whatever lies in its path and prepare these fuels to



RECIPE FOR A FIRE

burn more rapidly. When a fire reaches this stage there is little that man can do. Nature is the dominating force in such fires and only rain or snow can extinguish a blaze of this magnitude.

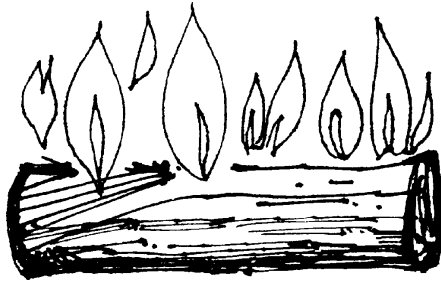
We have all seen the nightly news showing fire jumping from one tree to another. Did you know that technically these trees are not really on fire? It is not the forest that is burning. The fuel is actually turning into a gas. It is the gas that burns. The next time you light a fire in your fireplace look at the logs. If you look closely you can see a space between the log and the flame. There is little oxygen on the surface of the log. The gases made by the chemical reaction when heat is applied to the fuel need to rise slightly to mix with oxygen in order to burn. The same process is taking place when fireballs of flame explode several feet above a tree.

Understanding the fire triangle is critical in understanding why certain actions are taken, especially in a wildland fire. Backfires and prescribed fires (situations where fire is deliberately set to control fuel loads) are methods used by firefighters and are sometimes misunderstood by the general public.

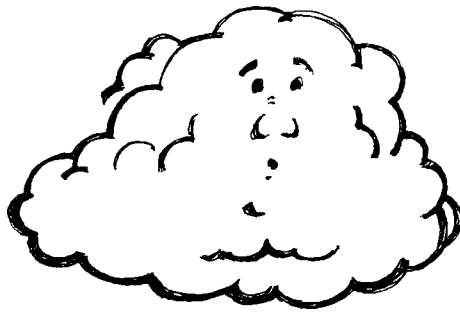
Fire, as it moves, involves a changing situation. Fire itself changes its environment. In essence, in their attempt to suppress a fire the professionals are mixing a recipe in which the ingredients are known but the quantities going in and out of the recipe are constantly changing.

PROCEDURE:

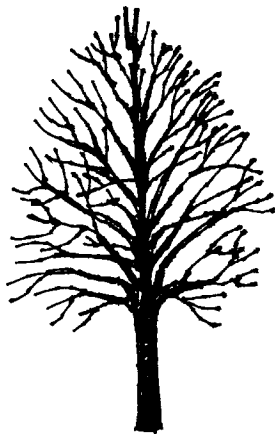
1. Before the activity begins, the teacher will need to make the "necklace" cards found in this lesson. These cards have pictures and are labeled Fire, Heat, Fuel and Oxygen. Glue the cards on a 5"X 8" index card and laminate if possible. With a hole punch or scissors make a small hole on both ends of the card. Pull string through the holes and tie the ends together to make a necklace. The string should be long enough to slip easily over the students' heads.
2. The teacher will designate the appropriate number of students as Fire, Heat, Fuel and Oxygen. **Example:** A class of 25 students would need two students designated as Fire, five students as Heat, eight students as Fuel and 10 students as oxygen. A larger number of students are designated as oxygen because a fire needs at least 16% oxygen to ignite. The oxygen "necklace cards" are labeled with varying percentages of oxygen.
3. The teacher will need to set boundaries and establish two "home bases" for the students designated as Fire to bring Heat, Fuel, and Oxygen back to.
4. The students designated as Fire need to collect sufficient Fuel, Heat and Oxygen to survive. They do this by tagging a student wearing one of the element cards. Tagged students are led back to "home base" prior to Fire tagging the next required element. Reminder: A fire needs 16% Oxygen to survive.
5. If the students designated as Fire are able to capture sufficient amounts of the Fire Triangle (heat, fuel and oxygen) and bring them back to their home base, the fire survives. If not, the triangle topples and the fire is extinguished.
6. The teacher can repeat the steps as many times as he/she feels is necessary.



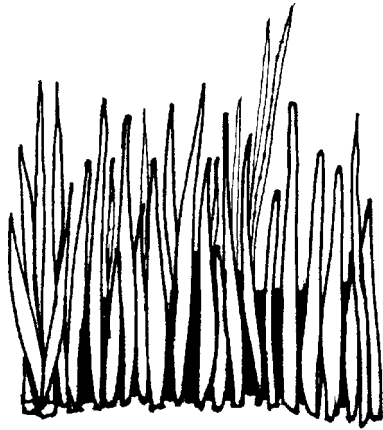
Fire



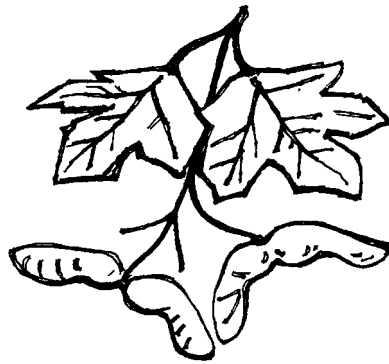
Oxygen - 6%



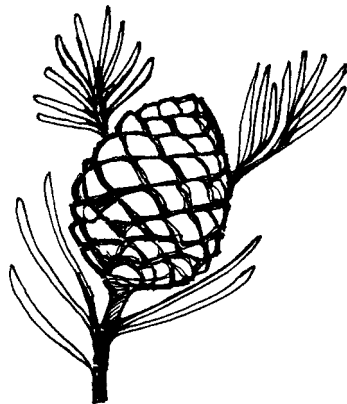
Fuel



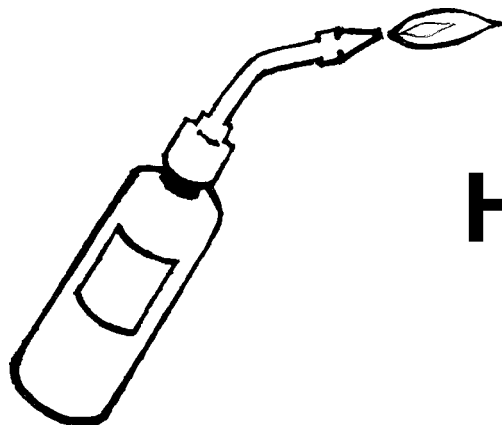
Fuel



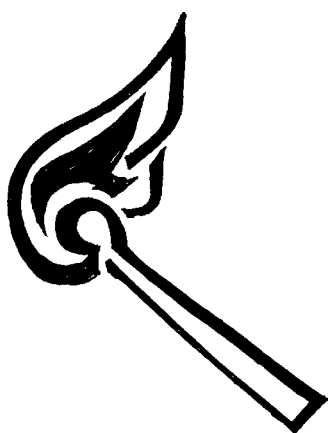
Fuel



Fuel



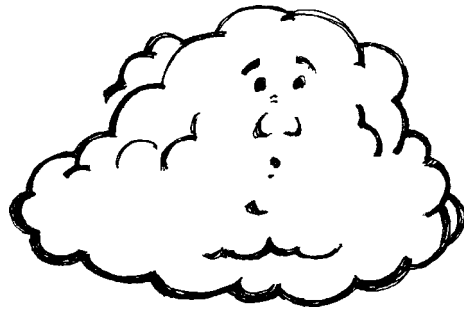
Heat



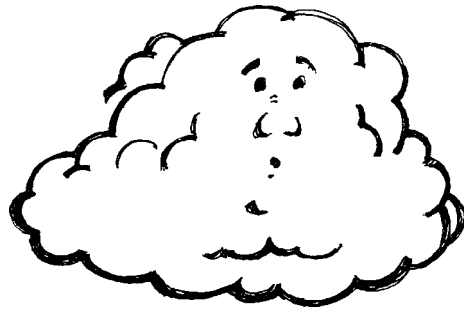
Heat



Heat



Oxygen - 20%



Oxygen - 10%



Oxygen - 8%

RECIPE FOR A FIRE

CLOSURE: Fire is an element that has been used and feared by man from the beginning. The recipe – Heat, Fuel and Oxygen – is one of the few things in nature that never changes. Fire can be friend, heating our homes in the dead of winter, or foe, destroying what man and nature hold dear.

EVALUATION: The teacher is able to evaluate the students by observing how well they put together the elements to build the Fire Triangle.

EXTENSIONS:

1. The students could invite a guest speaker from a local fire department to discuss the danger of fire and how to prevent fires around or in their homes.
2. Students could bring in newspaper articles about fires that have affected their community.